Review of U.S. Human Space Flight Plans Committee
Minutes for the Public Meeting of the Committee
October 8, 2009

Meeting via Teleconference
1:00-2:00 PM EDT

Committee Members participating:
Norman Augustine, Chairman
Dr. Wanda Austin
Mr. Bohdan Bejmuk
Dr. Christopher Chyba
Dr. Edward Crawley
Mr. Jeff Greason
Dr. Charles Kennel

The Committee Executive Director, Philip McAlister, began the teleconference, explaining to members of the public listening that the documents about to be discussed are posted on the Committee web site, under the listing for that day's meeting. He then introduced the Committee Chairman, Norman Augustine.

Mr. Augustine thanked the Committee members for attending the meeting and for their extended hard work on the Committee's full report, which is to be published shortly. He also welcomed the members of the public listening in to the teleconference and thanked them for their interest.

Mr. Augustine explained that at the final, in-person public meeting that the Committee held in Washington, on August 12, the Committee rated various individual factors for the integrated options it had offered. There were 12 factors, such as Schedule & Programmatic Risk, Technology Innovation and Science Knowledge. The Committee did not seek to assign rankings to the overall integrated options, but rather just to the factors within those options that relate to the benefits and the liabilities of those individual factors. Also, the Committee did not rate the overall options, because it was not asked to do that. To do so, Mr. Augustine continued, would have required that the Committee apply some kind of judgment as to what the relative weighting should be for each of those factors. That, he said, is beyond the Committee's capability. For example, the Committee is not in a position to judge the possibility of adding funds to the various programs.

According to Mr. Augustine, when the Committee evaluated the individual factors that reflected the strengths and weaknesses of each of those integrated options, it used the Program of Record as its reference value. So all the factors for the other approaches or alternatives were weighted according to the extent to which they were better or poorer than the Program of Record. As the Committee completed its work, following the Washington meeting, it concluded that it would be useful to assign descriptors to the numbers in that relative rating system. When the Committee did that, it found that it needed to transform the Program of Record into this new descriptor category of ranking. So it is really a transformation of the earlier numbers of the Program of

Record into this new figure of merit, Mr. Augustine said. That was the purpose of the current, October 8 meeting.

Mr. Augustine then introduced Dr. Edward Crawley, who chaired the subcommittee that focused on these integrated options and their interpretation. Dr. Crawley explained that the 12 evaluation measures are presented in two charts, the first seven associated with benefits such as Exploration Preparation, Expanding Human Civilization and Global Partnership. The remaining five are programmatic evaluation measures such as Workforce Impacts, Programmatic Sustainability and Life Cycle Cost. Both charts have a new feature, showing the traceability of these criteria to various other reference documents.

Dr. Crawley started by pointing out that Mission Profile Safety Challenges are the safety challenges associated with executing the mission profile and not a reflection on the specific vehicle or system that the Committee has in that profile. Also, on Chart 2, "Workforce" implies full critical skills and overall workforce impact.

Dr Crawley said that the third and fourth charts show the rubrics used in the Summary Evaluation Criteria, coded by red, yellow, white, green and blue—with red signifying -2 up to blue as +2. When the Committee met on August 12, it had all of this information in front of it, Dr. Crawley continued, and the Committee used it as the basis when it deliberated on the rankings that were to be assigned to the individual options in each of these categories.

The Scoring Update document shows the part of the grid that the Committee did not fill in at the August 12 meeting. Using an algorithmic approach agreed upon at the meeting, the Committee subgroup was to continue work on three criteria: Science Knowledge, Schedule and Life Cycle Costs. These would be filled in once the results of the affordability analysis developed by Aerospace Corporation were completely refined.

The algorithm for Science Knowledge was: If, in the interval under consideration (which was extended to 2020), a given scenario reached the Moon, it was given an increment from 0 to 1. If, in the interval, it reached a near-Earth object or another planet, it was given an additional increment of 1. So, Options 3, 4A and 4B, which are lunar strategies, scored a 1, and Option 5 scored a 2.

The Schedule algorithm was interpreted as when the significant accomplishment beyond low-Earth orbit occurred. The 0 ranking was about in the middle of the 2020s, which is what Options 3 and 4 accomplished, according to the affordability analysis. The Flexible Path options get out a few years earlier and therefore get a 1. And Options 1 and 2 never reach that point in the interval under consideration and therefore get a -2.

For Life Cycle Costs, the Program of Record is the reference, equal to 0, Dr. Crawley explained. If the option included commercial crew, it was incremented up 1 because of the expected lower recurring cost of the commercial crew launch to low-Earth orbit. If it used the EELV heavy, that is Option 5B, it was incremented up an additional 1; and if it used a Shuttle-derived heavy, it was incremented down 1.

The adjoining columns show an adjustment made after the August 12 meeting: Workforce and national skills, formerly separate, were combined into a composite workforce skills metric. The only option that the Committee identified that would not have some negative effects on the preservation of national skills was Option 4B, in which the continuation of the Shuttle through about 2015 made a significant contribution to preserving the national skills associated with human spaceflight.

Dr. Chyba suggested a modification to the Science Knowledge evaluation measure, adding the ability to service science observatories in space. If the integrated option reached neither the Moon nor a near-Earth object nor provides the capability to service science observatories in space, then it would get a 0; if it would do one of those things, it would get a 1; and if it would do any two of them, it would get a 2. With that modification, he noted, the resulting numbers would not change. Dr. Austin and Dr. Kennel spoke in favor of the proposed revision.

Dr. Crawley then turned to the bottom part of the Scoring Update, which is scoring the baseline program, or Option 3, the Program of Record. After the August 12 meeting, it became evident that this had not been done. The "mental model," as Dr. Crawley said, was that as a reference value, the baseline program would get a 0 in all categories. The other options would be incremented up or down from 0, leaving the baseline more or less as a set of zeroes.

Dr. Crawley explained that three of the categories are essentially already taken care of: Science Knowledge, Schedule and Life Cycle Cost for the baseline, or Option 3, have actually been filled in by the algorithm. So it is really the remaining nine that the Committee should have discussed at the August 12 meeting, he said.

Dr. Crawley then explained that for six of these, there really is no conflict. He outlined the rationale for assigning a score of 0 in categories such as Exploration Preparation and Expanding Human Civilization.

For Global Partnerships, Dr. Crawley proposed that the score for the Program of Record be changed from 0 to -2, because it does not extend the life of the International Space Station (ISS) past 2015. This change would make the scoring on that option consistent with the score given to other options in which the ISS is not extended. All Committee members agreed.

For the category Mission Profile Safety Challenges, Dr. Crawley recommended that the score for the Program of Record be changed from the current 0 to -1. Again, that is to be consistent with the scoring on other options. The rubric for that category makes clear, he said, that a mission to low-Earth orbit should constitute a 0. A score of -1 applies to missions such as one to a near-Earth object, or to a lunar landing. The baseline program does include a lunar landing.

Mr. Bejmuk objected, arguing that the Program of Record should be scored higher in this category because it employs the Ares I rocket, which "is about as simple as you can get." He noted that the Ares I has a single engine in the first stage and a single engine in the second stage. An extended discussion followed. Dr. Crawley and Mr. Augustine pointed out that the proposed -1 score was based on the comparative missions, not the vehicles. An agreement was established in which Mr. Bejmuk and the other Committee members would accept the proposed scoring

change, but elsewhere in the Committee's final report—in the discussion of launch vehicles—the document would spell out the safety benefits of simplicity in vehicle design. That portion of the report would underscore this principle in general, rather than endorse a particular design.

Finally, Dr. Crawley recommended one more scoring change for the Program of Record. Instead of 0, he said, the option should be scored at -1 in the category of National Skills. He explained that this would bring the scoring of the Program of Record in line with the scoring of all the other options in which there would be a significant gap in human spaceflight between when the Shuttle terminates and when the replacement crew-launch system becomes available. The Committee members agreed.

In concluding the meeting, Mr. Augustine noted three action items from the discussion. First, Dr. Crawley will revise the report text to reflect the Committee's decisions on revised scoring. Second, Mr. McAlister will ensure that the report's table of metrics for Science Knowledge incorporates the modification concerning the ability to service science observatories in space, as suggested by Dr. Chyba. And finally, Dr. Crawley will make sure that the report text addresses the safety benefits of simplicity in rocket design.